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Abstract

Using detailed ownership data for a sample of European commercial banks, we analyze the link between ownership structure and risk in both privately owned and publicly held banks. We consider five categories of shareholders that are specific to our dataset. We find that ownership structure is significant in explaining risk differences but mainly for privately owned banks. A higher equity stake of either individuals/families or banking institutions is associated with a decrease in asset risk and default risk. In addition, institutional investors and non-financial companies impose the riskiest strategies when they hold higher stakes. For publicly held banks, changes in ownership structure do not affect risk taking. Market forces seem to align the risk-taking behavior of publicly held banks, such that ownership structure is no longer a determinant in explaining risk differences. However, higher stakes of banking institutions in publicly held banks are associated with lower credit and default risk.

JEL Classification: G21; G32
Keywords: Ownership structure; Bank risk; European banks; Market discipline

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1. Introduction

The past three decades have been characterized by repeated banking crises, such as the financial crisis of 2008, the U.S. savings and loans debacle of the 1980s, the 1994–1995 Mexican crisis, and the 1997 Asian and 1998 Russian financial crises. Such episodes highlight the inherently unstable nature of banking and the tendency of banks toward excessive risk taking. In this paper, we focus on a driving force behind the risk-taking incentives of banks—namely, shareholders' behavior and their incentives to take higher risk. The issue of ownership structure is of particular interest for the banking industry because several factors interact with and alter governance, such as the quality of bank regulation and supervision and the opacity of bank assets. Moreover, banking systems have faced major changes during the past 20 years. With financial deregulation and market integration, the scope of banks' activities has been completely reshaped, from traditional intermediation products to an array of new businesses. These trends have led to substantial consolidation in the banking industry and, consequently, to significant changes in ownership and capital structure. In addition, institutional ownership of common stock has increased substantially over the past 20 years, which also implies changes in corporate governance and banks' behavior in terms of risk taking.

However, because of greater separation of ownership and control, firms with publicly held equity face different agency problems than privately owned firms.[2] Indeed, in publicly held banks, ownership is more likely to be dispersed among a large number of shareholders. This implies that the separation between shareholders and managers is more effective for publicly held banks than for privately owned banks. Such separation between shareholders and managers can increase information asymmetry and therefore create divergence in incentives (Jensen and Meckling, 1976). Privately owned banks are usually characterized by

[2] Publicly held banks are banks that are publicly quoted (i.e. banks whose stocks are traded on a stock exchange). Privately owned banks are all other banks.

less separation between owners and managers. The latter have a relatively larger equity stake, and therefore their incentives are more closely aligned with those of shareholders. Moreover, in privately owned banks, shareholders can more easily gain access to managers' private information that facilitates the monitoring of their actions. The choice to be publicly held or privately owned also implies differences in terms of market discipline and access to capital markets. For publicly traded banks, market forces can influence risk-taking incentives. On the one hand, the market is expected to monitor or influence banks' risk behavior, and therefore the impact of ownership changes on risk cannot be assessed without considering incentives driven by financial markets in terms of discipline (Bliss and Flannery, 2002; Flannery, 2001). In the Basel II Capital Accord, market discipline is one of the three pillars, along with capital regulation (first pillar) and banking supervision (second pillar). The idea is to rely on market forces to enhance banking supervision or to mitigate shareholders' risk-taking incentives, and consequently market discipline should play an important role for publicly held banks and, to some extent, for privately owned banks that strongly rely on market debt. On the other hand, banks that are publicly held might have different objectives in terms of growth and risk-return strategies. Public equity is more liquid than private equity and thus can be raised at a lower cost. Therefore, if publicly held banks' purpose to access capital markets is to finance faster growth opportunities, they are likely to take on more risk than privately owned banks.

To our knowledge, no research has addressed whether risk may be different for privately owned banks and publicly held banks under specific ownership profiles. Working with a sample of U.S. bank holding companies (BHC), Kwan (2004) finds no difference in loan quality and earnings variability between traded BHCs and privately owned BHCs, whereas Nichols et al. (2009) find that publicly held banks exhibit relatively larger loan loss allowances and loan loss provisions than privately owned banks. Thus, our aim herein is to

assess banks' risk-taking behavior by combining the two interrelated dimensions of ownership structure and market discipline.

According to theoretical and empirical literature, agency problems and risk-taking behavior are different depending on the nature of the shareholder. A first issue is the conflict of interest between managers and shareholders identified by Jensen and Meckling (1976). Theory indicates that shareholders with a diversified portfolio are motivated to take more risk for a higher expected return whereas managers take less risk to protect their position and personal benefits and to preserve their acquired human capital (Galai and Masulis, 1976; Jensen and Meckling, 1976; Demsetz and Lehn, 1985; Esty, 1998). Empirically, Saunders et al. (1990) were the first to test the relationship between banks' ownership structure and their risk-taking incentives. They find a positive relationship between managerial stock ownership (proportion of stock held by managers) and risk taking. Moreover, they find that banks controlled by shareholders take more risk than banks controlled by managers. In line with Saunders et al. (1990), several studies find a significant effect of ownership concentration on risk taking but without any consensus on the sign of such a relationship. That is, some studies find a negative relationship, whereas others obtain a U-shaped relationship (or inverse U shape) between ownership concentration and risk (Gorton and Rosen, 1995; Chen et al., 1998; Anderson and Fraser, 2000), which could be explained by managers' entrenchment. Moreover, Sullivan and Spong (2007) show that stock ownership by hired managers is positively linked with bank risk, meaning that under certain conditions, hired managers operate their bank more closely in line with stockholder interests.

Existing research also analyzes how the level of ownership concentration affects bank performance. The effects of ownership concentration on firm performance are theoretically complex and empirically ambiguous. Shleifer and Vishny (1986) and Aghion and Tirole (1997) show that a concentrated ownership may improve firms' performance by increasing

monitoring and alleviating the free-rider problem in takeovers. Conversely, other theoretical works show that large shareholders may exercise control rights to create private benefits and sometimes to expropriate smaller investors (Shleifer and Vishny, 1997). Another potential cost of concentration may result if managerial initiative is repressed by excessive monitoring (Burkart et al., 1997). Working with the 10 largest publicly listed banks in 48 countries, Laeven and Levine (2009) find that banks with more powerful owners tend to take higher risks. In contrast, working with a panel of 50 countries, Shehzad et al. (2010) find that when ownership concentration is greater than 50%, the volume of non-performing loans decreases. Their results further reveal that when shareholder protection rights are weak, ownership concentration is beneficial for the bank.

Another well-developed issue in the literature involves comparing the performance (profitability and asset quality) of state-owned banks with that of their private counterparts. Agency costs within government bureaucracy can result in weak managerial incentives and misallocation of resources. According to the agency cost view, managers exert less effort than their private counterparts or divert resources for personal benefits, such as career concerns. From the political view of state ownership, government-owned banks are inefficient because of politicians' deliberate policy of transferring resources to their supporters (Shleifer and Vishny, 1986; Shleifer, 1998). According to prior research, state-owned banks have poorer loan quality and higher default risk than privately owned banks (Berger et al., 2005; Iannotta et al., 2007). Iannota et al. (2007) also suggest that mutual banks and government-owned banks are less profitable than privately owned banks. Moreover, they find that government-owned banks have poorer loan quality and higher default risk, whereas mutual banks have better loan quality and lower asset risk than both privately owned and government-owned banks. In addition, some research has shown that foreign-owned banks exhibit better

performance than other banks, particularly in developing countries (Claessens et al., 2001; Bonin et al., 2005; Micco et al., 2007).

In addition to the issues of the manager/owner conflict and the differences between state-owned and privately owned firms, other aspects have been well established in the literature on non-financial firms but not on financial firms. First, institutional investors (e.g., investment companies, investment advisors, pension funds) who exercise significant voting power can shape the nature of corporate risk taking. In terms of shareholder size and expertise in processing information and monitoring managers, such investors are different from atomistic individual investors because they can exert greater control for reasons of economies of scale in corporate supervision. Pound (1988) shows that institutional investors can exercise control at a lower cost because they have more experience. However, managers and institutional investors may also form an alliance, in which insider interests take priority over the maximization of firm value. At the same time, because institutional investors have a diversified portfolio of investments, they may have lower incentives to exercise control. Empirical evidence (Acker and Athanassakos, 2003) based on non-financial firms does not provide conclusive results on the effect of control by institutional investors on firm value. Second, family-owned firms are perceived not only as less willing to take risk but also as less profitable. More generally, firms with large, undiversified owners such as founding families may forgo maximum profits because their wealth is not sufficiently diversified. Families also limit executive management positions to family members, suggesting a restricted labor pool from which to obtain qualified and capable talent, potentially leading to competitive disadvantages relative to non-family-owned firms (Morck et al., 2000). However, James (1999) posits that families have longer investment horizons that lead to greater investment efficiency. Stein (1988, 1989) shows that the presence of shareholders with relatively long investment horizons can mitigate the incentives for myopic investment decisions by

managers. Regarding the banking industry, little research has analyzed this issue. Laeven (1999) considers different forms of bank ownership, including state-owned, foreign-owned, company-owned and family-owned banks, but not banks owned by institutional investors. Working with a panel of Asian banks before the Asian crisis of 1997, he finds that family-owned banks were among the most risky banks, along with company-owned banks, whereas foreign-owned banks took little risk relative to other banks.

The objective of this paper is to extend the current literature regarding how ownership structure affects bank risk taking and profitability in several directions. First, we work on a broader classification of shareholders by considering not only the equity held by managers, individuals/families, and non-financial companies but also the equity held by institutional investors and banks. Second, we consider the proportion of equity held by each category of owner instead of using dummy variables to divide ownership into mutually exclusive categories, as does most of the previous studies on bank ownership (Berger et al., 2005; Bonin et al., 2005; Boubakri et al., 2005; Williams and Nguyen, 2005). Therefore, we can measure the level of ownership dispersion/concentration within each of the five categories of shareholders we consider. In addition, we can check whether the level of ownership dispersion matters when assessing the relationship between ownership structure and bank risk/profitability (Laeven and Levine, 2009; Shehzad et al., 2010) by examining ownership dispersion within each category of shareholders. Working with continuous variables instead of binary variables also enables us to analyze how the interaction of equity held by different types of shareholders influences banks' risk-taking behavior. This allows us to study the link between ownership structure and risk more thoroughly by dealing with the issue of possible coalitions among different categories or groups. Nevertheless, for consistency with previous studies we also study the link between risk and the nature of the main shareholder. Third, by investigating the link between ownership structure and risk for both listed (publicly held) and

non-listed (privately owned) banks, we question the ability of market forces to influence bank risk-taking behavior (market discipline) under different ownership arrangements. Fourth, previous studies that use a detailed breakdown of the stakes held by different categories of owners were mostly dedicated to U.S. banks and therefore did not consider as many categories of shareholders because ownership of banks by non-financial companies is not permitted. By studying European banks, we are able to introduce an additional category, non-financial firms, which according to the literature are controversial in influencing the management of financial institutions. Studies on European banks have focused on the nature of ownership (e.g., public, private, mutual, cooperative) rather than on the structure of ownership in privately owned banks. In this paper, we consider only one category of banks. We focus on commercial banks because they have homogeneous objective functions; to our knowledge, this is the first study to explore the relationship between ownership structure and risk for European commercial banks.

We work on a panel of European banks through the 1999–2005 period. Our results show that different ownership structures imply different levels of risk and profitability, but such findings hold mainly for privately owned banks. Publicly held banks with different ownership structures do not present different levels of risk and profitability, suggesting that market forces align the risk behavior of such banks.

The remainder of the paper is structured as follows: In Section 2, we describe the data and variables. In Section 3, we present the methodology and the hypotheses. In Section 4, we discuss the empirical results. In Section 5, we report robustness checks and discuss further issues. Section 6 concludes the paper.

2. Data, variables and descriptive statistics

2.1. Data collection and sample definition

We take the annual data used in this paper from BankScope Fitch IBCA, which provides information on financial statements and ownership structure for financial institutions worldwide. We collect the percentage of stocks held by shareholders by considering the following categories: managers/directors, institutional investors, non-financial companies, self-ownership, individual/family investors, banks, foundations/research institutes, government, unnamed private shareholders and other unnamed shareholders. BankScope Fitch IBCA also provides for listed banks data on the percentage of stocks held by the public (i.e., by small, not identified investors). We use a sample consisting of an unbalanced panel of annual report data from 1999 to 2005 for a set of European commercial banks established in 16 Western European countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom.[3] As argued previously, we do not consider other types of banks (e.g., cooperative, mutual) to ensure that all the banks in our sample follow the same profit maximization objective (homogeneous objective function). We identify in BankScope 1586 commercial banks for which income statements and balance sheets are provided for the 1999–2005 period.[4] We delete all the banks with less than five consecutive years of time series observations,[5] which leaves us with 688 banks. Of these banks, we isolate 320 for which detailed data on direct ownership are available for the years 2001, 2003 and 2005 in the annual financial statement.[6] Eventually, we apply other selection criteria and end up with a

[3] We exclude Norway from our analysis because no banks provide data consistent with the criteria we use to build and clean our database.

[4] All the banks in our sample publish their annual financial statements at the end of the calendar year. We consider local Generally Accepted Accounting Principles (GAAP) for all our sample period.

[5] This condition enables us to accurately compute the standard deviations of some variables to define risk indicators.

[6] Each annual financial statement provides information on the banks' ownership structure for the current year and the previous two years. For example, the report of the year 2001 gives information on the ownership structure of the years 1999, 2000 and 2001. In our study, we consider the direct owner, who can be different from the ultimate owner (e.g., 20% of a bank's stocks can be owned by a firm [direct owner] in which a family might have a stake of 10%). We use direct ownership to consider the different categories that directly exert control. We do not consider the ultimate owners because BankScope only provides information on such owners since 2004 and only for shareholders with stakes greater than 25%.

smaller sample of banks. First, we only consider banks with a stable ownership structure by comparing the proportion of equity held by the main shareholders over the 1999–2005 period. This restriction is important to accurately analyze the impact of ownership structure on the performance and risk of banks. Because our aim is to focus on the influence of different categories of shareholders on management, we need to exclude short-term ownership and hit-and-run strategies that do not shape management behavior and, therefore, bank risk/profitability in a given direction.[7] Thus, we only keep banks for which the ownership shares of the main category of shareholders fluctuate by less than 10% over the considered period. In total, 249 banks are consistent with this criterion, which enables us to work on a firm-level homogeneous sample. The final sample consists of 249 European commercial banks, 80 of which are listed as publicly traded banks[8] (see Table 1 for further details on the distribution of banks by country). Of these banks, 191 have a major shareholder with a stake greater than 50% throughout the whole sample period, and 58 banks (of which 44 are listed) exhibit ownership shares by the main shareholder fluctuating by less than 10%. We also consider a subsample that satisfies the criteria that the sum of the different shares displayed in BankScope is at least equal to 99%.[9] This criterion leaves us with 198 banks, 29 of which are listed. We test the robustness of our results by running our estimations on both the large sample of 249 banks and the restricted sample of 198 banks. To be consistent with previous

[7] As an anonymous referee noted, this restriction could be relaxed to check for robustness of results and to possibly capture deeper insights in our investigation. Indeed, even large changes in ownership structure may not alter management behavior, specifically for publicly and widely held institutions. However, to estimate the risk measures, we need to compute standard deviations over the whole sample period because we use annual data that cover a relatively short period (1999–2005). In other words, we can assign only one risk value to a bank throughout the sample period. Relaxing this restriction by considering banks that had ownership changes would not allow us to track possible risk changes.

[8] Our full dataset contains 137 listed banks. We need to delete (1) 7 banks with less than five years of time series observations; (2) 31 banks for which ownership is not detailed in the three reports provided for the years 2001, 2003 and 2005; and (3) 19 banks that exhibit a change in ownership structure between 1999 and 2005. The banks classified as listed were continuously publicly quoted throughout the sample period. Seven banks that were delisted in the early years of our sample are classified as non-listed banks in our study. We do not include banks that were non-listed (listed) for some years but became listed (delisted). Our approach, which considers a sample of banks with stable ownership structures, might explain why few banks were alternatively listed and non-listed on a stock exchange over the sample period.

[9] The data on ownership structure provided by BankScope (% share of each type of owner) do not always add up to 100%, particularly for listed banks, because we do not always have the percentage held by the public.

studies, we also conduct estimations on the sample of 191 banks for which we have a major shareholder with a stake greater than 50%.

Insert Table 1 here

Table 2 presents descriptive statistics for both our sample of 249 banks and the largest sample of 1586 commercial banks available in BankScope Fitch IBCA for our period of analysis. We use data from consolidated accounts if available and from unconsolidated accounts otherwise.

Insert Table 2 here

2.2. Risk variables

We consider different measures of asset risk and default risk commonly used in the literature**.** We compute three standard measures of risk for each bank throughout the period under study on the basis of annual accounting data: the standard deviation of the return on average assets (*SDROA*), the standard deviation of the return on average equity (*SDROE*),[10] and the mean of the ratio of loan loss provisions to net loans (*M_LLP*). We also compute default risk measures. First, we use the "Z-score" proposed by Boyd and Graham (1986), which indicates the probability of failure of a given bank (*Z*).[11] Higher values of Z-scores imply lower probabilities of failure. Second, we use the ZP Score (*ZP*) as in Goyeau and Tarazi (1992) and Lepetit et al. (2008) and its two additive components (*ZP1* and *ZP2*).[12] *ZP1* is a measure of bank portfolio risk, and *ZP2* is a measure of leverage risk.

Table 2 provides statistics for our measures of asset risk and default risk, on average for the whole sample of banks, and for the panel of non-listed and listed banks. Mean tests show that there are no significant differences in risk between our two samples of publicly owned and privately owned banks. These results are consistent with those of Kwan (2004),

[10] We define average equity and average assets at time *t* as (amount outstanding at time *t* + amount outstanding at time *t–1*)/2.

[11] $Z = (100 + \text{average } ROE) / SDROE$, where *ROE* and *SDROE* are expressed in percentages.

[12] $ZP = ZP_1 + ZP_2 = \frac{\text{average } ROA}{SDROA} + \frac{\text{average}(\text{Total equities} / \text{Total assets})}{SDROA}$.

who examines a panel of U.S. banks. However, unlike his findings, our sample of European publicly held banks exhibits, on average, a higher profitability than our sample of European privately owned banks. An explanation for the higher profitability for listed banks could be that such banks can raise additional equity capital at lower transaction costs, which enables them to generate faster growth in equity and assets and, thus, to become larger. These banks might also benefit from economies of scale and generate higher profit per unit of risk than privately owned banks.

2.3. Ownership variables

In our study, we code the ownership structure according to the stockholder information contained in the BankScope database. Because our aim is to analyze how the interaction of equity held by different types of shareholders influences banks' risk-taking behavior, we must consider as many categories of owners as possible. However, we only keep the categories of owners for which we are able to identify their nature, behavior and incentives to take risk. Therefore, we exclude three categories of owners that BankScope provides: public, unnamed private shareholders and other unnamed shareholders. We also require each category of owner to hold equity in at least five banks. These criteria lead us to exclude three categories of owners: self-owned, foundation and government.[13]

Consequently, we end up with five categories of owners in our study: (1) managers/directors (*MANAGER*), (2) non-financial companies (*COMPANY*), (3) individual/family investors (*FAMILY*), (4) banks (*BANK*), and (5) institutional investors (*INSTITUT*), such as insurance companies, financial companies and mutual and pension funds. We create five variables that report the proportion of equity held by each category of owner for each bank in our sample. This approach allows us to measure the dispersion of ownership and also to analyze the influence of different combinations of shareholders on bank

[13] Few European banks have equity held by governments, and those that do are mostly German cooperative banks, which we do not consider in our sample.

risk and profitability. It also enables us to account for possible coalitions among different categories of shareholders.[14]

Descriptive statistics of our sample of 249 European commercial banks show that the major shareholder category is other banking institutions with an average of 81.52% of equity.[15] Non-financial companies and institutional investors are also strongly involved in our sample banks because they hold equity in 78 and 55 banks of the 249 banks of our sample, respectively. Non-financial companies hold, on average, a higher percentage of equity (39.48%) than institutional investors (35.40%). Individuals/families are involved in a relatively few number of listed and non-listed banks (25 banks). The category managers/directors holds equity in only 8 banks, of which 7 are listed banks, and the average proportion of stocks they hold is low (9.51%) compared with the other types of owners. All the shareholder categories exhibit, on average, higher stakes in non-listed banks than in listed banks. Statistics further show that the proportions of equity of each category of owner (except managers/directors) are well distributed in the interval [0–100]. There is also strong heterogeneity among different types of shareholders regarding risk and default risk indicators, which enables us to analyze the behavior of banks according to their ownership structure.

[14] As an anonymous referee noted, considering continuous variables (proportion of equity held by each category of shareholders) instead of dummy variables to capture the nature of the main shareholder requires significant attention. Indeed, changes in ownership from 3% to 5% will not have the same impact as changes from 49% to 51%. In our setting, we consider the proportion of equity held by several categories of shareholders that adds up to 100%. Therefore, a change in ownership of one category cannot be assessed without considering the outcomes for all the other categories. Specifically, an increase from 3% to 5% of one category can either significantly reduce the influence of another category (a drop from 51% to 49%) or not. Similarly, an increase from 24% to 26% might or might not have a significant impact depending on the stakes held by the other categories. Therefore, the impact of a change in ownership will depend on how equity is initially distributed among the five shareholder categories and not only on the initial proportion held by the category itself. As a whole, we cannot presume that a change in ownership from 4% to 6% will have a weaker impact than a change from 24% to 26%. The advantage of our approach is that it captures the effect on risk of various combinations of equity held by the different categories of shareholders. It also allows us to measure the level of dispersion/concentration within each of the five categories. However, because of the complexity of our approach, which simultaneously considers the stakes of all the shareholder categories, we also consider the nature of the main shareholder by introducing dummy variables instead of continuous variables.

[15] Extensive tables on the descriptive statistics of banks' ownership structure are available on request. We also compare our sample of 249 commercial banks with the larger population of European commercial banks for which BankScope Fitch IBCA provides information on the ownership structure in 2005 (905 commercial banks) by examining possible differences. The frequencies of banks for which each category of owner holds a positive percentage of equity in our sample are not significantly different from those of the largest sample of 905 banks.

We also compare asset risk, default risk, profitability and asset growth of publicly held and privately owned banks when held by the same main category of shareholders[16] (see Figure 1). Figure 1 shows differences in asset risk and profitability between listed and non-listed banks for a given shareholder type, but the differences are not statistically significant. However, we find that publicly held banks exhibit higher average asset growth rates than privately owned banks, regardless of the category of the main shareholder. These results suggest that, as discussed previously, publicly held banks can raise equity more easily and at lower cost to generate faster growth.

Insert Figure 1 here

We further measure the ownership dispersion/concentration of our sample of European commercials banks to analyze its possible impact on the risk-taking behavior of banks as in Laeven and Levine (2009) and Shehzad et al. (2010). Our data provide the proportions of total equity held by different categories of owners but not the stakes held by each investor at the individual level. Therefore, we need to check whether the level of ownership dispersion in each of the five categories of shareholders matters when assessing the relationship between ownership structure and bank risk/profitability. For this purpose, we measure ownership dispersion/concentration by computing a Herfindahl index for each of the five categories of shareholders[17] (*HERF_MANAGER, HERF_FAMILY, HERF_INSTITUT, HERF_COMPANY* and *HERF_BANK*). Descriptive statistics show that, on average, ownership is relatively well concentrated for all the shareholder categories. This is consistent with the studies of La Porta et al. (1999) and Becht and Roell (1999), who show that the

[16] The main category of shareholders is the one with the highest level of equity holding.

[17] For example, for the category *INSTITUT*, we compute for each bank *i* the variable OS_j, defined by the ratio of the percentage of equity held by each institutional investor *j* to the total percentage of equity held by all the institutional investors. We then compute the Herfindahl index as $\sum_{j=1}^{n} OS_j^2$, where *j* represents the category of shareholders *INSTITUT* and *n* is the total number of institutional investors that hold equity in the bank *i*. For example, if bank *i* has two institutional investors holding 10% of total equity and 45% of total equity, the Herfindahl index will take the value of 0.70, indicating a relatively high level of concentration for the category *INSTITUT*.

ownership structure of firms around the world presents a relatively high degree of ownership concentration. The category *BANK* exhibits a relatively high level of ownership concentration, followed by *FAMILY* and *INSTITUT*. The category with the highest number of shareholders per bank is *COMPANY*, with an average of 4.25 shareholders and a maximum of 66 shareholders involved in the same bank. We also find no significant differences in terms of risk and profitability between banks with a relatively high level of concentration for the categories of *FAMILY*, *INSTITUT* and *COMPANY* and those with a relatively low level of ownership concentration in these categories. In addition, there seems to be no impact of ownership concentration/dispersion on banks' risk-taking behavior. However, when banks hold equity in other banks and their stakes are concentrated, we find that asset risk and profitability are significantly higher than in banks with a more dispersed bank ownership.

3. Method and hypotheses tested

Our first objective is to analyze whether commercial banks with different ownership structures present significant differences in risk and profitability. We also investigate whether market discipline can influence the relationship between ownership structure and risk. Therefore, we test two hypotheses by considering two specifications.

Hypothesis 1: Different ownership structures imply different levels of risk and profitability.

We use the following econometric model to test hypothesis 1:

Model 1

$$\begin{aligned} Y_i = {} & \alpha_0 + \alpha_1 \text{MANAGER}_i + \alpha_2 \text{FAMILY}_i + \alpha_3 \text{COMPANY}_i + \alpha_4 \text{BANK}_i + \alpha_5 \text{LISTED}_i \\ & + \alpha_6 \text{M\_LNTA}_i + \alpha_7 \text{M\_OEQUITY}_i + \alpha_8 \text{M\_DEPOSIT}_i + \alpha_9 \text{M\_CIR} \\ & + \alpha_{10} \text{LAMBDA}_i + \alpha_{11} \text{LAMBDA*LISTED}_i + \gamma_j \sum_{j=1}^{15} \text{COUNTRY}_j + \varepsilon_i \end{aligned} \quad ,$$

where Y_i is a measure of asset risk (*SDROA*, *SDROE* and *M_LLP*), default risk (*Z*, *ZP*, *ZP1* and *ZP2*) or profitability (the mean of the return on average assets, *M_ROA*, and the mean of the return on average equity, *M_ROE*)[18]; *MANAGER*, *FAMILY*, *COMPANY* and *BANK* represent the percentage of stock held by managers/directors, individuals/families, non-financial companies, and banks, respectively [19]; *LISTED* is a dummy variable that takes the value of 1 if the bank is listed on the stock market and 0 if otherwise; *M_LNTA* is the mean of the natural logarithm of total assets; *M_OEQUITY* is the mean of the ratio of equity to total assets orthogonalized with total assets; *M_DEPOSIT* is the mean of the ratio of deposits to total assets; *M_CIR* is the mean of the ratio of total operating expenses to total operating income; *LAMBDA* is the inverse Mills ratio estimated for each bank from the first-stage probit model; and *COUNTRY* is a country dummy variable.

We consider five categories of owners that may influence banks' risk-taking behavior (*MANAGER*, *FAMILY*, *COMPANY*, *BANK* and *INSTITUT*). In our specification, we remove *INSTITUT* from Model 1 to use institutional investors as a benchmark ownership share. The theoretical link between risk and institutional ownership is the most settled. Because institutional investors hold shares in sufficiently diversified investment portfolios, they are assumed to favor all positive net present value investments at the individual bank level. As shareholders, institutional investors are indifferent to the riskiness of an investment in a specific bank and are only concerned about expected return. By removing *INSTITUT* from our set of independent variables, we can analyze, with Model 1, whether a shift in ownership from institutional investors to another category of owners results in an increase or a decrease in risk

[18] We do not include an independent variable reflecting asset risk when we consider profitability as the dependent variable, because we have a high degree of colinearity between our ownership variables and asset risk.

[19] To account for non-linearity in the impact of ownership changes on risk, an alternative method would be to introduce the squared term of ownership variables in the regression. However, because the ownership variables range from 0% to 100%, they are highly correlated with their squared terms. To check for robustness, we also run regressions with the squared terms only. Introducing the square of the ownership variables instead of the ownership variables in level provides identical results.

and profitability.[20] The excluded shareholder group *INSTITUT* is the benchmark against which we evaluate the signs and the magnitudes of the coefficients on the four other ownership shares.

The theory regarding the attitude of individuals/families toward risk stipulates that their portfolio is less diversified than those of other shareholders, particularly institutional investors, and therefore they have incentives to take less risk because, if the bank fails, they lose more than other shareholders. We expect that a shift in equity from institutional investors (*INSTITUT*) to individuals/families (*FAMILY*) results in a decrease in risk[21] (α_2 negative).

Previous studies that analyzed the incentives of managers/directors to take risk were mostly dedicated to U.S. firms. Most studies have shown that when a manager/director holds a small share of the bank's equity, he/she may have incentives to take less risk. If the bank fails, he/she loses both his/her reputation and human capital investment. Our *MANAGER* variable is close to the proxy used by Saunders et al. (1990), which they compute as the number of shares held by executive and directors divided by the total number of shares outstanding. Note that the underlying assumption in the literature is that a low proportion of stocks held by managers is associated with a low share of the bank's stocks in the managers' non-human wealth. In addition, a greater proportion of stocks held by managers is assumed to align their interest with those of shareholders as long as the larger investment in the bank's stocks does not prevent them from holding diversified portfolios. In our study, we do not have

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[20] Model 1 is defined as $Y_i = \alpha_0^{'} + \alpha_j^{'} \sum_{j=1}^{5} C_{ji} + \alpha_6 Z_i + \varepsilon_i$, where C_{ij} represent the five categories of shareholders and Z_i is a vector of control variables. Because we have $C_{5i} = 100 - \sum_{j=1}^{4} C_{ji}$, we can rewrite Model 1 as follows: $Y_i = (\alpha_0^{'} + 100\alpha_5^{'}) + \sum_{j=1}^{4} (\alpha_j^{'} - \alpha_5^{'}) C_{ji} + \alpha_6 Z_i + \varepsilon_i$. We can then estimate the following Model: $Y_i = \alpha_0 + \sum_{j=1}^{4} \alpha_j C_{ji} + \alpha_6 Z_i + \varepsilon_i$, with $\alpha_0 = \alpha_0^{'} + 100\alpha_5^{'}$ and $\alpha_j = \alpha_j^{'} - \alpha_5^{'}$, j=1,..,4.

[21] We give here the expected sign for the measures of asset risk (*SDROA*, *SDROE* and *M_LLP*). We expect the opposite sign for the default risk measures (*Z* and *ZP*) because a lower Z-score value implies a higher probability of failure.

information about managers' wealth and the level of diversification of their investment portfolio. We assume that the managers' portfolios are less diversified than those of our benchmark, institutional investors. Therefore, we expect a negative coefficient for the variable *MANAGER* (α_1 negative).

We also consider shares held by non-financial companies (*COMPANY*). Banks with a large portion of stocks held by firms are prone to increase the riskiness of loans granted to owners. Moreover, if a bank is behind an industrial group, the group management will have incentives to manipulate the bank to maximize the wealth of ultimate owners. Therefore, banks that are controlled by firms might have incentives to encourage riskier strategies than other categories, such as individuals/families. In addition, it could be argued that non-financial companies might hold sufficiently diversified asset portfolios similar to institutional investors. If this is the case, their risk incentives could be aligned with those of institutional investors. However, our data do not provide information on the structure of their investment portfolios. Therefore, the impact of a shift in equity from institutional investors to non-financial companies on bank risk is undetermined (α_3 non-significant or positive/negative).

Banks (*BANK*) represent the fourth category of shareholders. Our statistics show that banks hold important stakes in other banks. When a bank owns another bank, the important risk–return relationship and strategies are expected to be handled by the parent company, and not at its subsidiary firm. However, banks as a shareholder might encourage relatively conservative risk-taking strategies at the individual bank level for both safety net reasons and reputation concerns. In the event of financial distress or failure, the parent bank is expected to support its subsidiary, which can be costly. Therefore, we expect a negative coefficient for the variable *BANK* (α_4 negative).

The control variables we introduce account for size differences (mean of the natural logarithm of total assets *M_LNTA*), business differences (mean of the ratio deposits to total

assets *M_DEP*), leverage differences (mean of the ratio equity to total assets *M_EQUITY*) and managerial efficiency differences (mean of the ratio total operating expenses to total operating income, *M_CIR*). We also use alternative control variables (the ratio of loans to total assets and the ratio of net non-interest income to net operating income) to check for robustness. Both *M_LNTA* and *M_EQUITY* are highly correlated, and thus the leverage ratio is orthogonalized with total assets (*M_OEQUITY*). Because the information on the ownership structure of our sample of banks is invariant through time (1999–2005 period) and because we compute our measure of asset risk and default risk using the standard deviations of *ROA* and *ROE*, we conduct cross-section regressions. Therefore, we compute the means of our three control variables over the whole sample period. We also control for possible country-specific effects by including country dummies (*COUNTRY*).

We further check whether publicly held banks behave differently than privately owned banks, by including in Model 1 a dummy variable, *LISTED*, which takes the value of 1 if the bank is listed on the stock market and 0 if otherwise. We expect this dummy variable to capture differences in risk and profitability for listed and non-listed banks. Market exposure should influence the behavior of publicly held firms. However, the effect of market exposure on risk is unclear. On the one hand, market discipline should impose strong incentives on banks to conduct their business in a safe, sound and efficient manner, including an incentive to maintain a high level of equity capital to face potential future losses. On the other hand, publicly held banks can have access to additional equity at a lower cost than privately owned banks. Thus, publicly held banks might have a greater ability to become larger and make acquisitions. They also have a higher degree of freedom to manage their equity and meet the regulatory capital requirement, which gives them more flexibility to invest in risky projects with a higher expected return. Market forces might also impose a higher risk-adjusted return

for publicly held banks. Therefore, the expected sign associated with the variable *LISTED* is undetermined (α_5 non-significant or positive/negative).

We potentially have two endogeneity problems in our regressions, one with our ownership variables, which are continuous, and one with the binary variable *LISTED*. We address these two problems separately. Some studies (Demsetz and Lehn, 1985; Himmelberg et al., 1999; Gugler and Weigland, 2003) suggest that ownership is endogenous because it is influenced by the firm's level of performance and risk. One can also argue that investors might be attracted by banks with different risk levels. Some investors might simply choose to invest in banks with higher risk profiles to maximize their utility. We test for the presence of an endogeneity bias in the estimated equation for the three ownership variables for which we might encounter such a problem (*COMPANY*, *BANK* and *INSTITUT*). We consider several instrumental variables related to the legal environment of the banking system and to the nature of the bank's activities.[22] We first check whether our instrumental variables are valid. We select the instrumental variables that are correlated with the variables that might be endogenous (*COMPANY*, *BANK* and *INSTITUT*). We then ensure that our instrumental variables are not redundant when we have at least two available instruments and that the instrumental variables are exogenous by using the Anderson likelihood ratio test and the Sargan test. Finally, we use the Hausman test to determine whether our ownership variables are endogenous. The Hausman tests show that the endogeneity problem is not a major issue,[23] which implies that ordinary least squares (OLS) should be an efficient estimator.

[22] We consider several instrumental variables. First, we differentiate the banking systems according to their legal environment. We use the database of La Porta et al. (1998), which groups the countries into four general legal families: English common law origin, countries of French civil law origin, countries of German civil law origin and countries of Scandinavian civil law origin. Second, we classify our sample banks according to the nature of their activities (e.g., proportion of subsidiaries abroad, focus or diversification, extent of loan activities in the balance sheet). The strategies banks pursue do not change much over time and might influence the choice of shareholders.

[23] The Hausman tests show that the null hypothesis of exogeneity is not rejected for *INSTITUT* (except for *SDROA*, *Z* and *ZP2*), *COMPANY* (except for *SDROA*) or *BANK* (except for *ZP1* and *ROE*).

Whether a bank becomes publicly held or remains privately owned also raises potential endogeneity issues in our econometric specification. Banks will choose to become listed on a stock market or to remain privately owned on the basis of the expected future changes in growth and profitability. We account for possible endogeneity of this choice by using the Heckman (1979) two-stage approach as in Givoly et al. (2010) and Nichols et al. (2009). In a first stage, we use a probit model to determine the variables that influence the bank's choice to be publicly held or privately owned. We then use the estimates of the probit model to compute the inverse Mills ratio for each sample bank (*LAMBDA*).[24] In the second stage, we introduce the inverse Mills ratio as a control variable in Model 1. By including *LAMBDA* in Model 1, we control for the correlation between *LISTED* and the second-stage errors to obtain consistent coefficient estimates. We also introduce an interaction variable combining *LISTED* and *LAMBDA* to allow the coefficient to vary between listed and non-listed banks.

Our second objective in this paper is to further investigate the issue of market discipline. We test the extent to which market forces influence the behavior of publicly held banks under different ownership structures. As discussed previously, we can expect two effects from market discipline on the behavior of publicly held banks: (1) a decrease in risk, if market forces moderate the incentives of banks dominated by institutional investors or other shareholder categories that are rationally inclined to take higher risks, and (2) an increase in risk, if market forces align the objectives of publicly held banks to generate faster growth and obtain a higher risk-adjusted return. Because market forces might align the objective of listed banks, we expect that their ownership structure will not affect their risk level. These opposite

[24] We use mean tests to compare balance sheet and income statement characteristics between listed and non-listed banks (as in Table 2). We retain 10 variables of the 24 initially examined variables that are significantly different between listed and non-listed banks: consumer loans/total assets, total earning assets/total assets, total deposits/total assets, cash/total assets, ROA, liquid assets/total assets, net loans/total assets, asset growth rate, market funding/total assets, and equity/total assets. We use these variables to model the selection of public versus private status. The results from the probit model are available on request. The pseudo-R-square statistic indicates that the model explains almost 68% of the cross-sectional variation in the choice between public and private status in our sample.

effects of market forces on the risk behavior of publicly held banks lead us to test the following two alternative hypotheses:

Hypothesis 2a: Market discipline mitigates risk in publicly held banks that are owned or controlled by shareholder categories that would otherwise be inclined to take higher risk in a privately owned bank.

Hypothesis 2b: Different ownership structures do not imply different levels of risk and profitability for publicly held banks.

For this purpose, we estimate an augmented model that captures the interaction between the different categories of owners[25] (*FAMILY*, *COMPANY*, *BANK* and *INSTITUT*) and the dummy variable *LISTED*, which indicates whether a bank is listed. Therefore, we use the following model to test the alternative hypotheses 2a and 2b:

Model 2

$$\begin{aligned} Y_i = {} & \beta_0 + \beta_1 \text{FAMILY}_i + \beta_2 \text{COMPANY}_i + \beta_3 \text{BANK}_i + \beta_4 \text{FAMILY*LISTED}_i \\ & + \beta_5 \text{COMPANY*LISTED}_i + \beta_6 \text{BANK*LISTED}_i + \beta_7 \text{M\_LNTA}_i + \beta_8 \text{M\_OEQUITY}_i \\ & + \beta_9 \text{M\_DEPOSIT}_i + \beta_{10} \text{M\_CIR} + \beta_{11} \text{LISTED} + \beta_{12} \text{LAMBDA}_i + \beta_{13} \text{LAMBDA*LISTED}_i \\ & + \gamma_j \sum_{j=1}^{15} \text{COUNTRY}_j + \varepsilon_i \end{aligned}$$

As in Model 1, we use *INSTITUT* as a benchmark. Again, because we remove *INSTITUT* from the set of independent variables, the estimated coefficient of each interaction variable refers to a substitution between each ownership component and the *INSTITUT* component.[26]

[25] Managers hold stocks in only one non-listed bank, and therefore we cannot consider the variable *MANAGER* in Model 2.

[26] Similarly to Model 1 (see n. 21), we can rewrite Model 2 as follows:

$$Y_i = (\beta_0 + 100\beta_5 + 100\gamma_5 * \text{LISTED}_i) + \sum_{j=1}^{4} (\beta_j - \beta_5) C_{ji} + \sum_{j=1}^{4} (\gamma_j - \gamma_5) C_{ji} * \text{LISTED}_i + \lambda Z_i + \varepsilon_i .$$

Interaction variables measure the impact of market exposure on the relationship between the proportion of equity held by each category of owner and the dependent variable. A negative and significant value of the sum of the coefficients of the variable *COMPANY* and the interaction variable *COMPANY*LISTED* ($\beta_2 + \beta_5 < 0$) will indicate that a shift in equity from institutional investors to non-financial companies results in a decrease in risk for listed banks. Such a result would be consistent with hypothesis 2a. If the sum of these two coefficients is not significantly different from zero, our model will highlight that a change in the ownership structure of listed banks will not affect their risk level, which is consistent with hypothesis 2b.

4. Results

Tables 3 and 4 show the results obtained for Models 1 and 2. Because we do not face strong endogeneity issues, as discussed previously, we use OLS estimation techniques with the Heckman correction.[27] We also correct for heteroskedasticity following White's methodology. As we remove the ownership component "institutional investors" from Models 1 and 2, the estimated coefficient associated with each ownership component must be interpreted as the effect of a substitution between this component and the *INSTITUT* component.

Our results are consistent with hypothesis 1. We find that the proportion of total equity held by different categories of shareholders is significant in explaining risk and profitability differences (see Table 3).

First, as expected, our results show that larger portions of total stock held by individuals/families (which we compensate for by a decrease in the *INSTITUT* component) are associated with lower asset risk and credit risk. However, we also find that a shift in

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[27] We also estimate Models 1 and 2 without the Heckman correction when the inverse Mills ratio (*LAMBDA*) is not significant. The results regarding our variables of interest are unchanged.

equity from institutional investors to individuals/families is not significantly associated with a decrease in profitability. As argued previously, such shareholders hold less diversified portfolios than institutional investors and are often involved in the management of such banks. Regarding our default risk measures, the results show that a higher stake of individuals/families is associated with a lower probability of default (*Z*).

Second, we find that the coefficients associated with the variable *BANK* are not significant when the dependent variables are asset risk measures (*SDROA* and *SDROE*) or profitability measures (*ROA* and *ROE*). These results indicate that a shift in equity from institutional investors to banks is not associated with a different level of asset risk and profitability. In addition, we find a negative and significant relationship at the 10% level between the *BANK* ownership component and the credit risk measure (*M_LLP*). This result supports the hypothesis that, as shareholders, banking institutions encourage relatively conservative risk-taking strategies but only for traditional lending activities. In addition, our results show that default risk (*Z*) is lower when the proportion of shares held by such banking institutions increases.

Third, we do not find any significant coefficient associated with the variable *COMPANY*. A shift in equity from institutional investors to non-financial companies does not result in a change in asset risk, default risk or profitability. Such a result suggests that institutional investors and non-financial companies have similar risk-return objectives.

Last, we find a significant and negative relationship between the variable *MANAGER* and our credit risk measure (*M_LLP*). A shift in ownership from institutional investors to managers is associated with a lower level of credit risk, but our results also reveal a greater probability of default (*Z*). In addition, we find that a higher level of involvement of managers in equity has a positive impact on profitability. However, it should be noted that our data do not allow us to infer any accurate relationship between manager involvement and risk. As our

statistics show, managers rarely hold stocks in their own company in our sample. Moreover, seven of the eight banks in which they have a stake are listed banks.

Regarding the influence of market forces on bank performance, the coefficient associated with the variable *LISTED* in Model 1 is not significant. That is, there seems to be no significant difference in risk and profitability between listed and non-listed banks, suggesting that market forces do not strongly influence the risk behavior of listed banks in a specific way.

Insert Table 3 here

We further investigate the issue of market discipline with Model 2 by considering the interaction between the proportion of equity held by each category of owner and the exposure of banks to market forces (see Table 4). First, for non-listed banks, we find a negative and significant relationship between *FAMILY* and two of our risk measures (*SDROE* and *M_LLP*). Therefore, the result indicating lower asset risk when individuals/families hold a greater proportion of stocks (which we compensate for by a decrease in *INSTITUT*) holds for non-listed banks.

Second, our results reveal that for listed banks, a shift in equity from institutional investors to non-financial companies or individuals/families is not associated with a change in asset risk, default risk or profitability (except for *SDROA* for *FAMILY*, but only at the 7.64% level). These results are consistent with hypothesis 2b that changes in the ownership structure of listed banks do not lead to changes in risk. In addition, our results show that a decrease in the proportion of equity held by institutional investors, offset by an increase in equity held by banks, leads to lower credit risk and probability of default, but only for listed banks. Therefore, market forces may moderate the risk taking of banks with higher stakes by banking institutions when they are listed.

Insert Table 4 here

On the whole, our analysis shows that different ownership structures imply different levels of bank risk, which is consistent with hypothesis 1. We find that a higher level of involvement of either individuals/families or banking institutions results in a decrease in asset risk and default risk, which is not offset by lower profitability. Our results also show that a shift in equity from institutional investors to non-financial companies is not associated with any changes in asset risk, default risk or profitability, suggesting identical risk–return preferences of both categories of shareholders. When we further account for the impact of market exposure, we find that changes in the ownership structure of publicly held banks do not strongly affect risk. However, to some extent, credit risk and default risk are lower in listed banks when equity stakes are transferred from institutional investors to banking institutions.

5. Deeper investigation and robustness checks[28]

To further examine issues related to the influence of ownership structure on banks' risk-taking behavior, we carry out a deeper investigation of our sample.

5.1. Ownership dispersion/concentration within each category of shareholders

We account for and estimate the impact of the dispersion/concentration of ownership by augmenting Model 1 with interaction variables involving the different categories of owners (*MANAGER*, *FAMILY*, *INSTITUT, COMPANY* and *BANK*) and their respective Herfindahl index (*HERF_MANAGER, HERF_FAMILY, HERF_INSTITUT, HERF_COMPANY* and *HERF_BANK*). Table 5 presents the results. Our results show that the degree of ownership concentration of individuals/families, industrial companies and banking institutions does not influence the relationship between ownership changes and banks' risk-taking behavior. We

[28] We do not present most of the estimation results discussed in this section, but they are available on request.

also run our estimations on the two sub-samples of non-listed and listed banks.[29] Our results show that the degree of ownership concentration within each category of shareholders does not matter in the relationship between ownership structure and bank risk for both listed and non-listed banks. We only find that for non-listed banks, a higher level of involvement of individuals/families associated with a greater ownership concentration leads to a decrease in asset risk, but no change in profitability.

5.2. Shareholders protection

The degree of shareholders protection rights can influence the relationship between bank ownership structure and bank risk (Shehzad et al., 2010). Therefore, we account for the level of shareholders protection, which may influence the relationship between ownership structure and bank risk. For this purpose, we use the Investor Protections Index (IPI) following Djankov et al. (2008). This index, based on legal rules, measures the degree of legal protection of minority shareholders against expropriation by corporate insiders. Three dimensions are considered to build this index: (1) the transparency of transactions, (2) the liability for self-dealing, and (3) shareholders' ability to sue officers and directors for misconduct. The IPI value ranges from 1 (low protection) to 10 (high protection). We expect that when the level of protection of shareholders is low, shareholders will be less likely to exert effective control and their monitoring capability will also be small (Shleifer and Vishny, 1997; La Porta et al., 1998). Therefore, in our setting, large diversified shareholders (e.g., institutional investors) who have incentives to take more risk are more likely to be able to influence managers in countries with higher degrees of shareholder protection.

The mean value of the IPI is 5.46 for the 16 European countries we consider in our studies, with the highest shareholder protection in Ireland and the United Kingdom (IPI $\geq$ 8) and the lowest protection in Greece and Switzerland (IPI $\leq$ 3). We estimate Model 1 and

[29] We do not include *MANAGER* in these estimations because there is only one non-listed bank in which managers/directors hold equity.

Model 2 on two sub-samples that differentiate countries with a relatively low or high degree of protection of minority shareholders (IPI $\leq$ 5 including seven European countries in our sample, and IPI > 5 including nine European countries, respectively). The results show that larger portions of total stock held by individuals/families are associated with lower asset risk and credit risk only in European countries with a relatively low degree of shareholders protection. The results further show that regardless of the degree of shareholder protection, changes in the shares held by each ownership category in listed banks do not affect risk.

5.3. Size effect

We also conduct our estimations separately for large banks (total assets > €1 billion) and small banks (total assets < €1 billion) to further check for size effects on the relationship between ownership structure and banks' behavior in terms of risk taking.[30] The results show that shifts in equity are significant in explaining risk differences for both samples of large and small banks. A shift in equity from institutional investors to individuals/families results in lower asset risk and lower default risk for both small and large banks. Moreover, a higher level of involvement of individuals/families in small banks leads to a higher level of profitability, suggesting greater efficiency in management. In addition, the results show that a shift in equity from institutional investors to non-financial companies is not associated with a change in asset risk, profitability or default risk for large banks, whereas it leads to a decrease in asset risk for small banks.

5.4. Reliance on market debt

We further test the impact of market exposure on banks' risk-taking behavior under different ownership structure profiles by using another proxy. We argue that a bank that relies heavily on market debt is likely to be influenced by market forces even if it is not listed on a stock market. Therefore, we construct a dummy variable based on the ratio of market debt

[30] The distribution of banks according to the percentage of equity held by each category of shareholder does not allow us to accurately run Model 2 for the sub-samples of small and large banks.

plus uninsured deposits to total assets. We consider that banks with a ratio higher than the median of the sample can be effectively disciplined by the market. We run Model 2 by using this dummy variable to construct the interaction variables. We find that a shift in equity from institutional investors to individual/families results in lower asset and default risk for banks that have a relatively low ratio of market debt. The results also show that changes in the ownership structure of banks that strongly rely on market debt do not affect asset and default risk. These results are consistent with our hypothesis that market forces align banks' risk-taking behavior.

5.5. Nature of main shareholder

Finally, to be consistent with previous studies on ownership in banking, we also classify banks according to the nature of their main category of shareholders. The objective of using such a classification is to analyze whether banks' risk-taking behavior is different depending on the nature of the main category of shareholders. We run a differently specified regression on our subsample of 191 banks in which the major shareholder holds more than 50% of total equity. Thus, our sample includes (1) 0 manager-owned bank, (2) 4 family- and individual-owned banks, (3) 17 institutional investor-owned banks, (4) 28 company-owned banks, and (5) 142 bank-owned banks. We create the following four dummy variables, which take the value of 1 when ownership is greater than 50% of total equity and 0 if otherwise: *FAMILY_OWNED, INSTITUT_OWNED, COMPANY_OWNED* and *BANK_OWNED*. We do not consider manager-owned banks in our estimations because no banks have a majority of equity held by this category of shareholders. In addition, the limited number of banks for which we have a majority owner and our specific regression specification, which relies on dummy variables, do not allow us to introduce interaction variables as in Model 2. Our results show that banks that are majority owned by individuals/families exhibit a lower asset risk

level (*SDROE* and *M_LLP*) but not a lower profitability. We also find that banks that are majority owned by other banking institutions exhibit a lower credit risk.

In addition, we estimate the same model by considering that there is a majority ownership when a category of owner holds a percentage of total equity strictly above 33%. Our findings are unaltered for the variables of interest. The results highlight that both the degree of involvement of shareholders and the nature of the main category of shareholders influence the attitude of banks toward risk.

5.6. Robustness checks

We also perform several robustness checks. First, we estimate Model 1 and Model 2 using the restricted sample of 198 banks for which the sum of the different equity components is at least equal to 99%. We consider this restricted sample to ensure that our results are not biased by missing or unreported information in the BankScope dataset regarding ownership structure. We also estimate Models 1 and 2 on a subsample from which we exclude observations with a value of 0 for the proportion of equity held by institutional investors. Our conclusions remain unchanged.

Second, we estimate Model 1 on the two sub-samples of privately owned and publicly held banks. The results regarding our ownership variables are unchanged. We find that a shift in equity from institutional investors to individuals/families results in a decrease in asset risk and default risk whereas a higher level of involvement of non-financial companies does not involve any changes in risk and profitability. For listed banks, the results show that bank ownership structure changes do not affect risk taking, except that risk is lower when equity stakes are transferred from institutional investors to banking institutions.

Third, we also run separate regressions introducing our ownership variables one by one along with the control variables. We find that a higher level of involvement of institutional investors leads to a greater probability of default for both listed and non-listed

banks. The results also show that a higher level of involvement of individuals/families leads to lower asset risk, but only for non-listed banks. A greater proportion of equity held by either non-financial companies or banking institutions does not affect risk taking, for both privately owned and publicly held banks.

Fourth, we also perform several specification-related robustness checks. We introduce other control variables to account for business differences in the estimations, such as the ratio of loans to total assets and the ratio of net non-interest income to net operating income. Our conclusions regarding the inclusion of the ownership variables remain unchanged.

6. Summary and concluding remarks

The objective of this study is to analyze whether different ownership structures are associated with different levels of risk and profitability in both privately owned and publicly held banks. We differentiate five categories of shareholders that are assumed to have different risk-taking incentives (managers/directors, institutional investors, non-financial companies, individuals/families and banks). We use the proportion of equity held by institutional investors as a benchmark ownership share to evaluate the impact of changes in ownership structure on risk and profitability. Our aim is also to assess whether publicly held and privately owned banks respond differently to such changes in terms of risk and profitability. Therefore, we analyze the influence of market discipline by testing whether ownership structure changes lead to different levels of risk and profitability for listed banks.

Working with a panel of European commercial banks and using both asset risk and default risk measures, we find that changes in ownership structure are significant in explaining risk differences. However, by investigating the relationship further, we note that such findings are mainly accurate for privately owned banks.

Specifically, we show that a shift in equity from institutional investors to either individuals/families or banking institutions results in a decrease in asset risk and default risk,

but no change in profitability. This result is consistent with the conjecture that because individuals/families hold less diversified portfolios than institutional investors, they have incentives to take less risk. Regarding banking institutions, when their stakes in other banks are higher, they seem to encourage relatively conservative risk-taking strategies in their subsidiaries, possibly because of reputation concerns. In addition, the results show that a shift in equity from institutional investors to non-financial companies does not involve changes in risk and profitability; this suggests that institutional investors and non-financial companies have similar risk-return objectives in the banks in which they are involved. We also note that the level of ownership concentration/dispersion within each category of shareholders does not influence the relationship between ownership structure and risk. However, we find that a higher level of involvement of individuals/families leads to lower risk taking in privately owned banks, but only in European countries where the level of shareholder protection is relatively low.

We further find no significant differences in asset risk and default risk between publicly held and privately owned banks. Moreover, unlike for privately owned banks, for publicly held banks, ownership structure changes do not affect risk taking. Market forces seem to align the risk-taking behavior of publicly held banks, such that ownership structure is no longer a determinant in explaining risk differences. Our results highlight that a higher level of involvement of banking institutions in publicly held banks leads to lower exposure to credit risk and a lower probability of default. Because bank supervisors provide guidelines for banks on safety and soundness, a closer examination of both the ownership structure and the nature of equity (public and tradable/private and non-tradable) would be worthwhile.

Table 1. Distribution of banks by country

	All banks	Non-listed banks	Listed banks
Austria	14	11	3
Belgium	7	7	0
Denmark	19	2	17
Finland	2	0	2
France	64	58	6
Germany	39	33	6
Greece	7	0	7
Ireland	5	1	4
Italy	17	4	13
Luxembourg	33	32	1
Netherlands	7	6	1
Portugal	2	0	2
Spain	15	3	12
Sweden	2	0	2
Switzerland	3	2	1
United Kingdom	13	10	3
Total	249	169	80

Table 2. Descriptive statistics for our panel of 249 European commercial banks, on average over the 1999–2005 period

	LOANS	DEP	EQUITY	CIR	LLP	ROA	ROE	LIQUID	OBS	TA	SDROA	SDROE	Z	ZP
Large sample of commercial banks available under BankScope (1586 banks)														
Mean	46.58	26.72	12.13	71.70	0.68	0.82	8.03	29.16	29.05	10 410	1.14	8.20	46.70	47.26
Maximum	99.97	97.64	69.52	992.10	14.49	19.24	39.95	100.00	857.47	1 330 000	53.26	216.02	590.40	496.77
Minimum	0.00	0.00	0.00	0.16	-14.98	-20.00	-38.25	0.00	0.00	0.991	0.00	0.00	0.23	0.37
Std. Dev.	29.72	26.73	11.77	51.29	1.95	2.28	9.97	26.75	75.07	64 435	3.04	14.45	65.03	61.57
Our sample of 249 banks														
Mean	50.15	39.06	9.41	67.80	0.54	0.81	9.52	24.50	32.15	20 200	0.58	6.98	44.03	37.17
Maximum	94.71	93.31	68.24	538.21	9.09	16.59	30.82	87.09	887.90	839 000	7.67	143.06	511.66	190.76
Minimum	0.76	0.00	1.06	12.02	-10.99	-4.04	-38.66	0.24	0.02	4 554	0.01	0.003	0.56	0.51
Std. Dev.	24.66	26.04	8.51	40.48	2.00	1.43	9.23	20.65	73.68	83 900	0.94	12.81	56.13	32.35
T-statistic of the mean test	-2.06**	-6.92***	4.42***	1.47	1.03	0.09	-2.34**	3.16***	-0.61	-1.76*	5.78***	1.37	0.68	3.92***
Non-listed banks (169)														
Mean	45.55	31.65	9.71	70.37	0.48	0.63	8.02	28.36	33.56	3 820	0.61	7.77	43.63	36.98
Maximum	94.71	93.31	66.78	538.21	9.09	4.87	30.82	87.09	887.90	52 400	7.67	143.06	511.66	190.76
Minimum	0.76	0.00	1.47	12.02	-10.99	-4.04	-38.66	0.31	0.02	4 554	0.01	0.003	0.56	0.51
Std. Dev.	25.96	25.98	8.81	47.88	2.41	1.04	9.78	23.18	86.32	7 990	0.97	14.74	58.64	32.35
Listed banks (80)														
Mean	59.87	54.71	8.79	62.38	0.66	1.18	12.67	16.33	29.10	54 800	0.51	5.32	44.87	37.50
Maximum	88.84	86.94	68.24	116.20	3.39	16.59	25.55	47.28	141.52	839 000	5.58	50.93	396.34	136.62
Minimum	9.09	3.84	1.06	25.98	-0.98	-2.86	-20.21	0.24	0.90	57 462	0.01	0.28	1.57	1.27
Std. Dev.	18.28	18.09	7.84	14.97	0.54	1.98	7.00	9.87	32.76	142 000	0.88	6.96	50.83	27.04
T-statistic of the mean test	-4.43***	-7.15***	0.79	1.97**	-0.66	-2.87***	-3.81***	4.45***	0.44	-4. 65***	0.79	1.41	-0.16	0.46

T-statistics test for the null:"Descriptive statistics are not different between the two samples considered. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively, for a bilateral test. Variable definitions (all variables are expressed in percentages except *TA*, which is in million of euros): *LOANS* = net loans/total assets; *DEP* = deposits/total assets; *EQUITY* = equity/total assets; *CIR* = total operating expenses/total operating income; *LLP* = loan loss provision/net loans; *ROA* = return on average assets; *ROE* = return on average equity; *LIQUID* = liquid assets/total assets; *OBS* = off balance sheet/ total assets; *TA* = total assets (millions of euros); *SDROA*= standard deviation of the ROA; *SDROE* = standard deviation of the ROE; *Z* = Z-score = (100 + average ROE) / SDROE ; and

$$ZP = \text{ZP-score} = \frac{\text{average ROA}}{\text{SDROA}} + \frac{\text{average (Total equities / Total assets)}}{\text{SDROA}} .$$

Table 3. Influence of ownership structure on the risk-taking behavior and profitability of banks (Model 1), cross-section OLS regressions

	Risk measures			Default Risk measures				Profitability measures	
	SDROA	SDROE	M_LLP	Z	ZP	ZP1	ZP2	M_ROA	M_ROE
CONSTANT	0.0190	-5.387	3.394*	40.92	17.67	-1.698	19.37	3.230***	26.71***
	(0.03)	(-0.45)	(1.77)	(1.37)	(0.40)	(-0.30)	(0.48)	(4.56)	(4.59)
MANAGER	0.00503	-0.0117	-0.0291	-0.868*	-0.591	-0.0736	-0.518	0.0198**	0.276**
	(0.54)	(-0.08)	(-1.62)	(-1.85)	(-1.11)	(-1.16)	(-1.07)	(2.06)	(2.09)
FAMILY	-0.00416*	-0.0801***	-0.0178**	0.404**	0.137	-0.00548	0.142	-0.00152	-0.00291
	(-1.83)	(-2.94)	(-2.27)	(2.20)	(0.74)	(-0.33)	(0.84)	(-0.51)	(-0.11)
COMPANY	-0.00290	0.0365	-0.00974	0.181	-0.00819	-0.0146	0.00641	-0.00186	-0.00219
	(-1.26)	(0.55)	(-1.15)	(1.32)	(-0.06)	(-1.08)	(0.05)	(-0.66)	(-0.07)
BANK	-0.00163	-0.0285	-0.0121*	0.232*	0.0966	-0.00142	0.0981	-0.000550	-0.00308
	(-0.87)	(-1.19)	(-1.79)	(1.80)	(0.75)	(-0.09)	(0.84)	(-0.28)	(-0.16)
M_LNTA	0.0612*	1.149*	-0.115	-4.385**	-3.604	0.118	-3.722	-0.0823**	-0.269
	(1.97)	(1.88)	(-1.28)	(-2.12)	(-1.16)	(0.43)	(-1.26)	(-2.06)	(-1.03)
M_OEQUITY	0.0669***	0.00379	-0.0559**	-0.270	-0.898	-0.106*	-0.792	0.0443***	-0.141**
	(6.99)	(0.04)	(-2.14)	(-0.60)	(-1.52)	(-1.75)	(-1.43)	(2.83)	(-1.98)
M_DEPOSIT	-0.00236	-0.00941	-0.0114	0.157	0.0906	-0.0656***	0.156	-0.00698**	-0.101***
	(-1.14)	(-0.25)	(-1.29)	(0.74)	(0.33)	(-2.98)	(0.59)	(-2.44)	(-4.01)
M_CIR	0.00637***	0.0534**	0.00216	-0.0690	-0.0715	-0.0377**	-0.0338	-0.0124***	-0.109***
	(3.96)	(2.08)	(0.38)	(-0.54)	(-0.45)	(-2.25)	(-0.21)	(-8.03)	(-3.90)
LISTED	0.102	3.176	-0.468	5.467	30.81	9.921**	20.89	-0.119	3.767
	(0.26)	(0.64)	(-0.67)	(0.25)	(0.94)	(2.16)	(0.72)	(-0.39)	(1.10)
LAMBDA	-0.0184	0.666	-0.131	1.756	7.281*	0.422	6.859*	-0.0538	-1.006*
	(-0.44)	(0.81)	(-0.72)	(0.61)	(1.69)	(1.02)	(1.71)	(-1.12)	(-1.97)
LAMBDA*LISTED	-0.176	-3.811	-0.108	2.077	-16.32	-5.969*	-10.35	0.140	-1.917
	(-0.53)	(-0.82)	(-0.31)	(0.15)	(-0.73)	(-1.83)	(-0.52)	(0.43)	(-0.71)
COUNTRY DUMMIES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	244	244	241	242	244	244	244	244	243
R2	0.363	0.108	0.106	0.121	0.0581	0.182	0.0545	0.514	0.414

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. T-statistics are corrected for heteroskedasticity following White's methodology. Variable definitions (standard deviations and means are computed over the 1999–2005 period): *SDROA*= standard deviation of the return on average assets; *SDROE* = standard deviation of the return on average equity , *M_LLP* = mean of the ratio of loan loss provisions to net loans; *Z* = Z-score; *ZP* = ZP-score; *ZP1*=measure of bank portfolio risk; *ZP2* = measure of leverage risk; *M_ROA*= mean of the return on average asset; *M_ROE*= mean of the return on average equity; *M_LNTA*= mean of the natural logarithm of total asset; *M_OEQUITY* = mean of the ratio of equity to total assets orthogonalized with TA; *M_DEPOSIT* = mean of the ratio of deposits to total assets; *M_CIR*= mean of the ratio of total operating expenses to total operating income; *LISTED* = a dummy variable that takes the value of 1 if the bank is listed on the stock market and 0 if otherwise; and *LAMBDA* is the inverse Mills ratio estimated for each bank from the first-stage probit model. The variables *MANAGER*, *FAMILY*, *COMPANY* and *BANK* represent the percentage of stock held by managers/directors, individuals/families, non-financial companies and banks, respectively. We also include dummy variables to account for country-specific effects.

Table 4. Influence of ownership structure on the risk-taking behavior and profitability of listed and non-listed banks (Model 2), cross-section OLS regressions

	Risk measures			Default Risk measures				Profitability measures	
	SDROA	SDROE	M_LLP	Z	ZP	ZP1	ZP2	M_ROA	M_ROE
CONSTANT (β_0)	0.200 (0.30)	-4.023 (-0.34)	3.818* (1.85)	60.47* (1.89)	6.111 (0.13)	-3.473 (-0.56)	9.583 (0.23)	3.038*** (4.72)	26.62*** (4.48)
FAMILY (β_1)	-0.00461* (-1.77)	-0.0806*** (-2.72)	-0.0209* (-1.96)	0.283 (1.62)	0.282 (1.62)	0.0143 (1.15)	0.268 (1.64)	0.000236 (0.08)	-0.00134 (-0.04)
COMPANY (β_2)	-0.00351 (-1.21)	0.0453 (0.55)	-0.0131 (-1.17)	0.0862 (0.55)	0.0927 (0.68)	0.00171 (0.16)	0.0910 (0.70)	-0.000253 (-0.08)	-0.00106 (-0.03)
BANK (β_3)	-0.00272 (-1.08)	-0.0367 (-1.22)	-0.0150 (-1.53)	0.0937 (0.67)	0.241* (1.70)	0.0185 (1.33)	0.223* (1.69)	0.000851 (0.37)	-0.00694 (-0.27)
FAMILY*LISTED (β_4)	-0.0167 (-1.30)	-0.118 (-0.70)	0.0138 (0.69)	0.304 (0.44)	-2.072 (-1.33)	-0.235 (-1.03)	-1.837 (-1.37)	-0.0170 (-1.07)	-0.0583 (-0.38)
COMPANY*LISTED (β_5)	0.000455 (0.11)	-0.0646 (-0.76)	0.0114 (1.10)	0.201 (0.82)	-0.189 (-0.71)	-0.0384 (-1.14)	-0.151 (-0.62)	-0.00565 (-1.10)	-0.0201 (-0.45)
BANK*LISTED (β_6)	0.00311 (0.72)	0.0387 (0.77)	0.00897 (0.90)	0.471 (1.55)	-0.459* (-1.73)	-0.0602* (-1.76)	-0.399* (-1.69)	-0.00479 (-1.02)	0.00376 (0.09)
M_LNTA (β_7)	0.0613* (1.97)	1.146* (1.89)	-0.116 (-1.27)	-4.391** (-2.11)	-3.854 (-1.25)	0.0878 (0.33)	-3.942 (-1.35)	-0.0816** (-2.05)	-0.238 (-0.90)
M_OEQUITY (β_8)	0.0666*** (7.00)	0.000139 (0.00)	-0.0571** (-2.23)	-0.323 (-0.73)	-0.842 (-1.41)	-0.0987 (-1.62)	-0.743 (-1.33)	0.0449*** (2.84)	-0.141** (-1.99)
M_DEPOSIT (β_9)	-0.00199 (-0.94)	-0.00578 (-0.15)	-0.0108 (-1.22)	0.191 (0.87)	0.0646 (0.23)	-0.0692*** (-2.98)	0.134 (0.50)	-0.00720** (-2.45)	-0.0996*** (-3.86)
M_CIR (β_{10})	0.00643*** (3.91)	0.0540** (2.10)	0.00236 (0.41)	-0.0594 (-0.47)	-0.0791 (-0.50)	-0.0388** (-2.25)	-0.0404 (-0.25)	-0.0125*** (-7.92)	-0.109*** (-3.85)
LISTED (β_{11})	-0.0477 (-0.13)	2.250 (0.43)	-1.079 (-1.00)	-20.48 (-0.90)	55.58 (1.33)	13.36** (2.20)	42.22 (1.17)	0.205 (0.56)	4.048 (1.03)
LAMBDA (β_{12})	-0.0175 (-0.42)	0.636 (0.80)	-0.128 (-0.70)	1.797 (0.62)	7.192* (1.65)	0.403 (0.98)	6.789* (1.67)	-0.0548 (-1.14)	-0.993* (-1.93)
LAMBDA*LISTED (β_{13})	-0.171 (-0.55)	-3.307 (-0.77)	-0.144 (-0.42)	2.493 (0.17)	-17.15 (-0.78)	-5.990* (-1.86)	-11.16 (-0.58)	0.155 (0.47)	-1.792 (-0.66)
COUNTRY DUMMIES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Risk level to reject $\beta_1 + \beta_4 = 0$	0.0915*	0.236	0.651	0.375	0.246	0.333	0.238	0.284	0.696
Risk level to reject $\beta_2 + \beta_5 = 0$	0.355	0.650	0.748	0.166	0.686	0.254	0.780	0.208	0.524
Risk level to reject $\beta_3 + \beta_6 = 0$	0.903	0.957	0.0940*	0.0441**	0.328	0.200	0.363	0.318	0.922
Number of obs.	244	244	241	242	244	244	244	244	243
R2	0.366	0.114	0.109	0.130	0.0628	0.190	0.0586	0.516	0.410

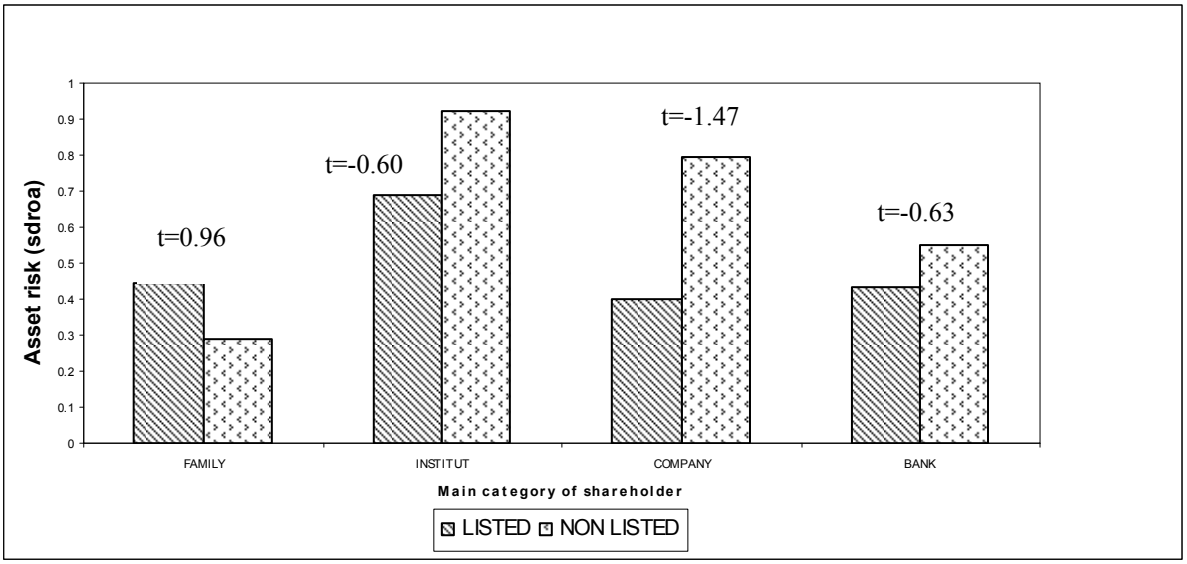
***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. T-statistics are corrected for heteroskedasticity following White's methodology. Variable definitions (standard deviations and means are computed over the 1999–2005 period): *SDROA*= standard deviation of the return on average assets; *SDROE* = standard deviation of the return on average equity , *M_LLP* = mean of the ratio of loan loss provisions to net loans; *Z* = Z-score; *ZP* = ZP-score; *ZP1*=measure of bank portfolio risk; *ZP2* = measure of leverage risk; *M_ROA*= mean of the return on average asset; *M_ROE*= mean of the return on average equity; *M_LNTA*= mean of the natural logarithm of total asset; *M_OEQUITY* = mean of the ratio of equity to total assets orthogonalized with TA; *M_DEPOSIT* = mean of the ratio of deposits to total assets; *M_CIR*= mean of the ratio of total operating expenses to total operating income*; LISTED* = a dummy variable that takes the value of 1 if the bank is listed on the stock market and 0 if otherwise; and *LAMBDA* is the inverse Mills ratio estimated for each bank from the first-stage probit model. The variables *FAMILY*, *COMPANY* and *BANK* represent the percentage of stock held by individuals/families, non-financial companies and banks, respectively. We also include dummy variables to account for country-specific effects.

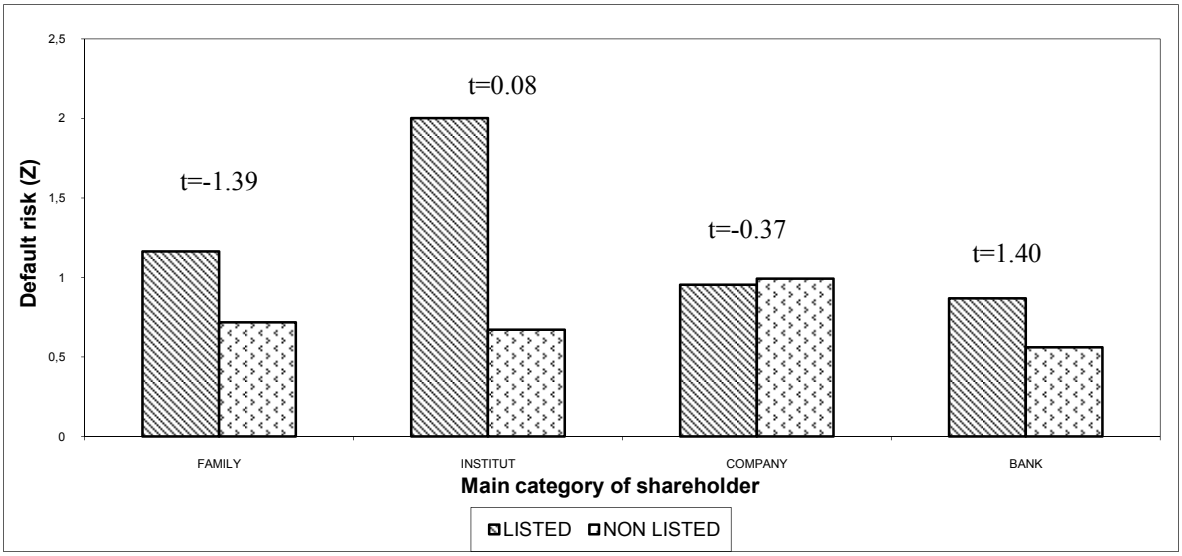
Table 5. Influence of ownership structure and ownership dispersion on the risk-taking behavior of banks, cross-section OLS regressions

	Risk measures			Default Risk measures				Profitability measures	
	SDROA	SDROE	M_LLP	Z	ZP	ZP1	ZP2	M_ROA	M_ROE
CONSTANT	-0.0244 (-0.03)	-7.854 (-0.65)	3.721* (1.77)	43.10 (1.33)	18.84 (0.41)	-2.642 (-0.46)	21.49 (0.52)	2.967*** (3.61)	25.11*** (3.44)
MANAGER	0.673*** (14.80)	7.957*** (11.51)	-0.0455 (-0.47)	-3.342* (-1.89)	-4.374* (-1.77)	-0.576** (-2.04)	-3.798* (-1.71)	0.0837 (1.35)	0.0128 (0.01)
FAMILY	-0.00180 (-0.52)	-0.0528 (-1.45)	-0.0168** (-2.07)	-0.0353 (-0.06)	-0.251 (-0.53)	-0.0349 (-0.86)	-0.216 (-0.49)	-0.00425 (-0.74)	-0.0458 (-1.32)
COMPANY	0.00227 (0.54)	-0.0333 (-0.43)	-0.0156 (-1.40)	0.0657 (0.19)	-0.0236 (-0.09)	0.0144 (0.46)	-0.0380 (-0.15)	-0.00617 (-0.83)	0.00846 (0.17)
BANK	-0.00583** (-2.11)	-0.0676* (-1.67)	-0.00372 (-0.33)	0.931 (1.60)	0.590 (1.00)	-0.00340 (-0.17)	0.594 (1.02)	-0.00321 (-0.93)	-0.0492 (-1.19)
MANAGER*HERF_MANAGER	-0.677*** (-14.28)	-8.051*** (-10.98)	0.0224 (0.22)	2.613 (1.23)	3.875 (1.47)	0.504* (1.68)	3.371 (1.42)	-0.0592 (-0.92)	0.303 (0.34)
FAMILY*HERF_FAMILY	-0.00562 (-0.69)	-0.0519 (-0.58)	-0.00141 (-0.10)	0.929 (0.65)	0.810 (0.84)	0.0625 (0.78)	0.747 (0.84)	0.00790 (0.69)	0.104 (1.22)
COMPANY*HERF_COMPANY	-0.00573 (-1.10)	0.0826 (0.57)	0.00603 (0.47)	0.125 (0.33)	0.0149 (0.04)	-0.0331 (-0.87)	0.0480 (0.15)	0.00436 (0.52)	-0.0174 (-0.25)
BANK*HERF_BANK	0.00443* (1.92)	0.0460 (1.34)	-0.00904 (-0.90)	-0.732 (-1.19)	-0.518 (-0.81)	0.000183 (0.01)	-0.518 (-0.82)	0.00210 (0.71)	0.0399 (1.15)
M_LNTA	0.0638* (1.87)	1.135* (1.86)	-0.110 (-1.21)	-3.932** (-2.14)	-3.273 (-1.06)	0.104 (0.35)	-3.377 (-1.16)	-0.0933** (-2.13)	-0.359 (-1.08)
M_OEQUITY	0.0656*** (6.50)	-0.0238 (-0.24)	-0.0531* (-1.95)	-0.150 (-0.36)	-0.808 (-1.35)	-0.0987 (-1.61)	-0.710 (-1.26)	0.0464** (2.51)	-0.118 (-1.25)
M_DEPOSIT	-0.00167 (-0.81)	-0.00101 (-0.02)	-0.0127 (-1.44)	0.0430 (0.29)	0.0117 (0.04)	-0.0651*** (-2.71)	0.0768 (0.31)	-0.00625** (-2.01)	-0.0906*** (-3.09)
M_CIR	-0.0000738 (-0.07)	0.0248 (1.65)	-0.00430 (-0.70)	-0.0895 (-1.38)	-0.0665 (-0.80)	-0.00383 (-0.39)	-0.0626 (-0.81)	-0.00285** (-2.40)	-0.0381*** (-2.67)
LISTED	0.229 (0.49)	4.360 (0.77)	-0.347 (-0.46)	9.221 (0.46)	33.04 (1.05)	9.004* (1.93)	24.04 (0.88)	-0.419 (-0.97)	1.079 (0.24)
LAMBDA	0.0503 (1.05)	1.324 (1.55)	-0.134 (-0.63)	0.142 (0.05)	5.951 (1.22)	0.0402 (0.10)	5.911 (1.27)	-0.186*** (-2.88)	-2.173*** (-3.36)
LAMBDA*LISTED	-0.174 (-0.48)	-3.495 (-0.72)	-0.157 (-0.45)	-1.117 (-0.08)	-18.73 (-0.82)	-6.004* (-1.77)	-12.73 (-0.64)	0.149 (0.39)	-1.951 (-0.61)
COUNTRY DUMMIES	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	244	244	241	242	244	244	244	244	243
R2	0.313	0.101	0.115	0.152	0.0654	0.155	0.0633	0.318	0.256

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. T-statistics are corrected for heteroskedasticity following White's methodology. Variable definitions (standard deviations and means are computed over the 1999–2005 period): *SDROA*= standard deviation of the return on average assets; *SDROE* = standard deviation of the return on average equity , *M_LLP* = mean of the ratio of loan loss provisions to net loans; *Z* = Z-score; *ZP* = ZP-score; *ZP1*=measure of bank portfolio risk; *ZP2* = measure of leverage risk; *M_ROA*= mean of the return on average asset; *M_ROE*= mean of the return on average equity; *M_LNTA*= mean of the natural logarithm of total asset; *M_OEQUITY* = mean of the ratio of equity to total assets orthogonalized with TA; *M_DEPOSIT* = mean of the ratio of deposits to total assets; *M_CIR*= mean of the ratio of total operating expenses to total operating income *; LISTED* = a dummy variable that takes the value of 1 if the bank is listed on the stock market and 0 if otherwise; and *LAMBDA* is the inverse Mills ratio estimated for each bank from the first-stage probit model. The variables *MANAGER*, *FAMILY*, *COMPANY* and *BANK* represent the percentage of stock held by managers/directors, individuals/families, non-financial companies and banks, respectively. *HERF_J* represents the Herfindahl index computed to measure the ownership dispersion for the category of shareholder J . We also include dummy variables to account for country-specific effects.

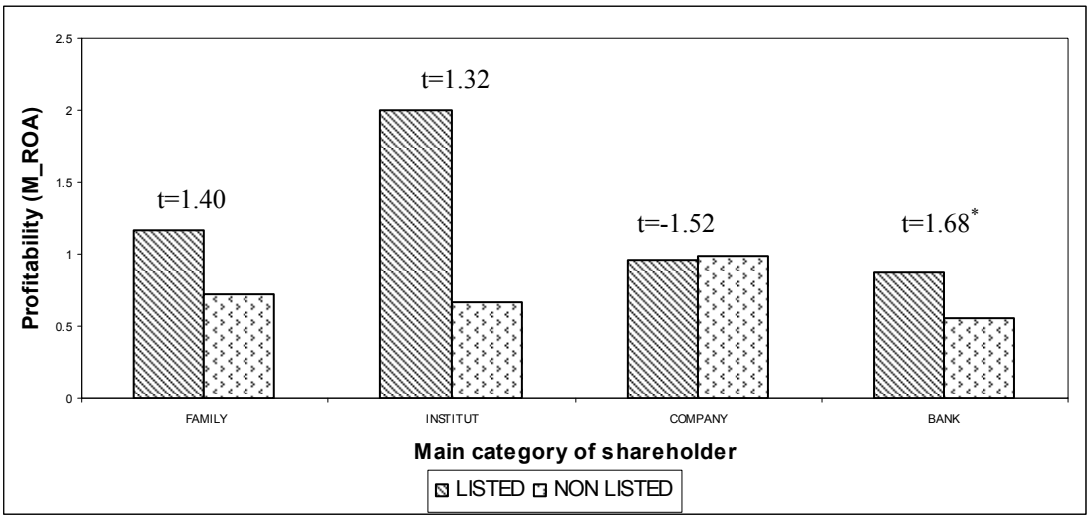
Figure 1. Asset risk, default risk, profitability and asset growth rate for publicly held and privately owned banks according to their main category of shareholder

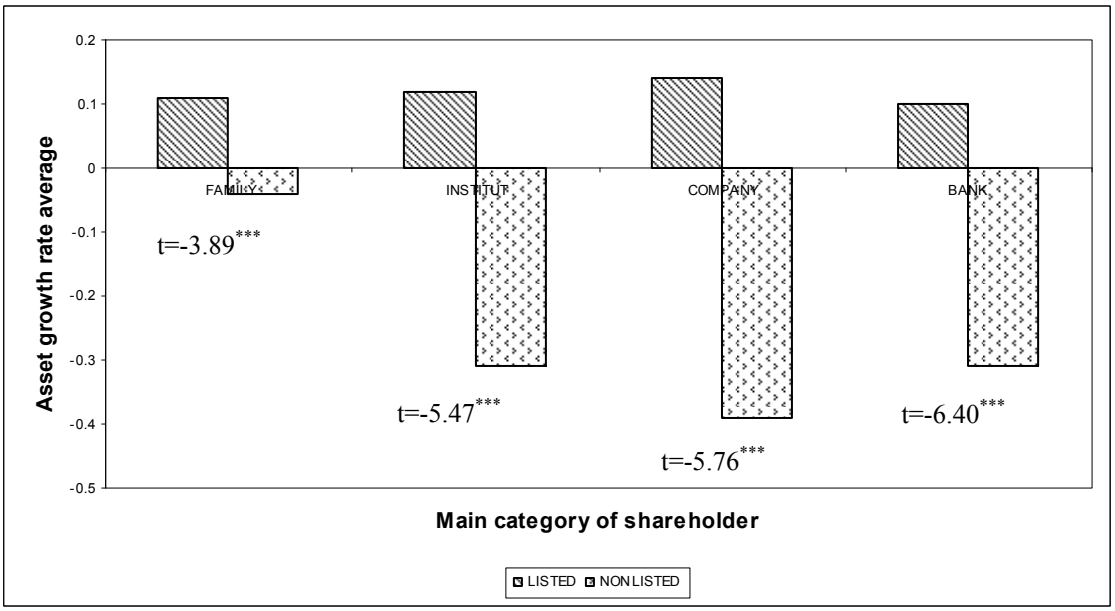




Note: We use the mode to determine the main category of shareholder of each bank; t represents the t-statistic of the bilateral mean test between listed and non-listed banks for banks with the same main category of shareholder. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Figure 1. (continue) Asset risk, default risk, profitability and asset growth rate for publicly held and privately owned banks according to their main category of shareholder





Note: We use the mode to determine the main category of shareholder of each bank; t represents the t-statistic of the bilateral mean test between listed and non-listed banks for banks with the same main category of shareholder. ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.

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